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JUNE 1986 NUMBER 214

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

June 1986 No. 214

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of May 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, down $0.25 since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,215,000** pounds U_3O_8 equivalent, up 1.6 million pounds since last month. The corresponding figure for **active demand** is **975,000** pounds, down 250 thousand pounds. The spot and near-term **supply-demand ratio** rose to **4.3:1.**

The *Current Market Data* section of this Report lists six natural uranium sales, involving approximately 1.2 million pounds equivalent U_3O_8 in the near term. Five of the transactions involved near-term delivery and three met the criteria for inclusion in the current Transaction Value calculation. Two transactions involved natural UF_6.

The **Transaction Value** is **$17.15** per pound U_3O_8, up $0.05 since last month. The calculation extends over a 4-month period and includes 13 transactions involving 2.1 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.25** per kilogram U in UF_6, down $0.25 since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, down $0.10 since last month. Active supply of secondary market conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. Three secondary market conversion transactions are reported.

The **Loan Rate** declined to **4 percent** per annum, down one percent.

* * *

The Exchange Value declined to $17.00, as the market for natural uranium concentrates weakened during May. Before the end of the month, substantial quantities of material became available at prices below last month's Exchange Value, and at least two transactions for significant quantities of concentrates took place at prices below $17.25. The slow upward movement of spot market prices that began in mid-1985 appears to have been interrupted due to increasing competition for sales and the willingness of sellers to lower their offering prices. Perhaps most important, demand for concentrates remains extremely thin, and an abundance of supply entering the market this month raised the supply-demand ratio to 4.3 to 1. A combination of purchases and withdrawals from the market reduced near-term demand to under one million pounds U_3O_8 equivalent.

The overall weakness in the market has now extended to the UF_6 market, as the UF_6 Value fell slightly; yet some demand still exists. An inquiry by a US utility to purchase a substantial quantity of UF_6 for near-term delivery, along with another utility's request, appeared early in the month, and both were filled quickly. However, a third UF_6 inquiry involving a large quantity was withdrawn by the potential buyer. Moreover, an earlier inquiry to purchase almost three million pounds U_3O_8 disappeared as the buyer declined all offers and withdrew from the market. Because that inquiry was discretionary in nature, the buyer was particularly price sensitive.

During the past few months, one unidentified seller has been and continues to be particularly aggressive in responding to every opportunity to offer material. In addition, some sellers are reducing effective prices by agreeing to longer payment terms or agreeing to accept current price levels for delivery as far in the future as the first quarter of 1987. In the past, such actions have often been a precursor to further price weakening.

Last month Nuexco noted that the price recovery that had been underway might be interrupted as a consequence of the market reaction to the Chernobyl accident, and that does appear to be the case. If so, it is evidence that the market is reacting far more rapidly than it did following the Three Mile Island Unit 2 accident in March 1979, when prices remained stable for several months before starting to decline. The complete extent of delays in plant start-ups, deferrals and any cancellations because of Chernobyl will not be apparent for months. Despite a few widely reported announcements, it is somewhat premature to comment, other than in a general sense, on the accident's eventual impact on the uranium market.

In the longer-term market, at least five utilities in the USA and abroad are in the final stages of selecting and negotiating supply arrangements with producers for deliveries beginning in the late 1980s. To date, these longer-term negotiations do not appear to have been significantly affected by developments in the spot market. Non-US producers continue to experience considerable success in the US market, in most cases reflecting their ability to offer the quantity flexibility and lower prices associated with large, lower-cost operations.

* * *

The Conversion Value dropped back to $1.80, as three secondary market transactions took place at prices slightly above and below that price. There is increased supply for secondary market conversion services, but the gap between sellers' offering prices and prices buyers are willing to pay has widened. The availability of UF_6, as well as only discretionary interest on the part of buyers, contributed to the decline in the Conversion Value. The algebraic sum of the Exchange Value and Conversion Value now closely approximates the UF_6 Value.

The Loan Rate declined to four percent per annum, a one-percent drop. At least one potential lender has indicated a willingness to loan material at that rate. Moreover, the gradual decline of interest rates in all sectors over the past year eventually requires that companies with excess uranium inventories wish-

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ing to lend adopt a lower rate. Because there are very few participants in the uranium lending market, however, changes in commercial interest rates are not felt as quickly. Despite the complications involved in arranging the necessary security, a lower rate could stimulate the emergence of borrowers and some lending activity in a market that has been nearly dormant for several years.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of May 31, 1986, is $75 per SWU, down $5 since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. No secondary market SWU transactions are reported this month.

One utility, now negotiating for the purchase of a large quantity of secondary market enrichment services, represented the only active opportunity during May. No other active buyers are in the market at present, and the availability of significant quantities of SWU offered at prices well below $80 reflects a weakening in the market, causing the SWU Value to decline. Nevertheless, small quantities of SWU might still command prices close to the $80 level.

* * *

The US Department of Energy has narrowed the list of possible sites for the high-level nuclear waste repository to three locations in the western and southwestern United States — Hanford, Washington; Yucca Mountain, Nevada; and Deaf Smith County, Texas. Efforts to locate sites for a second repository in the East and Midwest have been dropped. DOE plans to select one of the three sites by 1994. In upcoming Reports, Nuexco will examine the US government plans for all types of nuclear waste management.

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CURRENT MARKET DATA

May 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	4,215	975
UF_6 VALUE	**$48.25**/kgU		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	1,700	565
SWU VALUE 0.3 tails assay; delivery within one year	**$75**/SWU		
LOAN RATE	**4%**/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.15**	2.1	13	4

[1]Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)
Australia (dollar)	23.64	23.31	22.56	61.47	60.60	58.64
Belgium (comm. franc)	796.25	762.95	931.68	2,070	1,983	2,422
Canada (dollar)	23.41	23.79	20.64	60.86	61.84	53.67
Finland (markka)	89.62	84.98	95.97	232.98	220.92	249.50
France (franc)	124.82	119.46	140.98	324.49	310.57	366.51
FRG (mark)	39.21	37.51	46.30	101.93	97.51	120.36
Italy (lira)	26,759	25,723	29,492	69,567	66,875	76,674
Japan (yen)	2,923	2,893	3,773	7,599	7,521	9,810
Netherlands (guilder)	43.93	42.28	52.16	114.20	109.92	135.59
South Africa (rand)	39.44	35.46	29.97	102.54	92.18	77.92
Spain (peseta)	2,484	2,384	2,612	6,457	6,198	6,792
Sweden (krona)	123.91	120.88	133.45	322.13	314.27	346.95
Switzerland (franc)	32.46	31.37	39.00	84.39	81.55	101.40
UK (pound)	11.42	11.14	11.77	29.68	28.97	30.61
US (dollar)	17.00	17.25	15.00	44.20	44.85	39.00

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)
Australia (dollar)	23.85	23.11	21.73	62.01	60.08	56.49
Belgium (comm. franc)	803.28	756.30	897.52	2,088	1,966	2,333
Canada (dollar)	23.62	23.58	19.89	61.40	61.30	51.70
Finland (markka)	90.41	84.24	92.45	235.04	219.00	240.35
France (franc)	125.92	118.42	135.81	327.36	307.87	353.07
FRG (mark)	39.55	37.18	44.60	102.83	96.66	115.95
Italy (lira)	26,995	25,500	28,411	70,181	66,293	73,863
Japan (yen)	2,949	2,868	3,635	7,666	7,455	9,450
Netherlands (guilder)	44.32	41.91	50.24	115.21	108.96	130.62
South Africa (rand)	39.79	35.15	28.87	103.45	91.38	75.06
Spain (peseta)	2,505	2,363	2,516	6,514	6,144	6,543
Sweden (krona)	125.00	119.83	128.56	324.97	311.54	334.22
Switzerland (franc)	32.75	31.10	37.57	85.14	80.84	97.68
UK (pound)	11.52	11.05	11.34	29.94	28.72	29.49
US (dollar)	17.15	17.10	14.45	44.59	44.46	37.57

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on May 30, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)
Australia (dollar)	2.50	2.57	2.26	5.52	5.66	4.97
Belgium (comm. franc)	84.31	84.03	93.17	185.87	185.26	205.40
Canada (dollar)	2.48	2.62	2.06	5.46	5.78	4.55
Finland (markka)	9.49	9.36	9.60	20.92	20.63	21.16
France (franc)	13.22	13.16	14.10	29.14	29.01	31.08
FRG (mark)	4.15	4.13	4.63	9.15	9.11	10.21
Italy (lira)	2,833	2,833	2,949	6,246	6,246	6,502
Japan (yen)	309.49	318.63	377.36	682.31	702.46	831.93
Netherlands (guilder)	4.65	4.66	5.22	10.25	10.27	11.50
South Africa (rand)	4.18	3.91	3.00	9.21	8.61	6.61
Spain (peseta)	262.97	262.58	261.28	579.74	578.88	576.02
Sweden (krona)	13.12	13.31	13.35	28.92	29.35	29.42
Switzerland (franc)	3.44	3.46	3.90	7.58	7.62	8.60
UK (pound)	1.21	1.23	1.18	2.67	2.71	2.60
US (dollar)	1.80	1.90	1.50	3.97	4.19	3.31

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value delivery within one year (May 31, 1986)	UF_6 Value per kg.U in UF_6 This Month (May 31, 1986)	UF_6 Value per kg.U in UF_6 Last Month (Apr 30, 1986)
Australia (dollar)	104.31	67.11	65.54
Belgium (comm. franc)	3,513	2,260	2,145
Canada (dollar)	103.28	66.44	66.88
Finland (markka)	395.36	254.35	238.92
France (franc)	550.66	354.26	335.87
FRG (mark)	172.97	111.28	105.46
Italy (lira)	118,054	75,948	72,323
Japan (yen)	12,895	8,296	8,133
Netherlands (guilder)	193.80	124.68	118.87
South Africa (rand)	174.01	111.95	99.69
Spain (peseta)	10,957	7,049	6,703
Sweden (krona)	546.65	351.68	339.87
Switzerland (franc)	143.21	92.13	88.20
UK (pound)	50.37	32.40	31.33
US (dollar)	75.00	48.25	48.50

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on May 30, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3737	1986-1987	50-100	R[5]	US Producer	Trader	
3736	1986	101-300	R[5]	R[5]	US Utility	UF_6.
3731	1986	601-1,000	101	Canadian Producer	US Utility	UF_6.
3730	1988-1993	1,001-1,500	see remarks	Canadian Producer	US Utility	Market-related price.
3724	1986	50-100	99	US Producer	US Producer	
3719	1986	101-300	100	US Producer	Trader	

Conversion Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer	Remarks
3738	1986	50-100	103	R[5]	US Utility	
3735	1986	less than 50	100	Trader	Trader	
3708	1986	301-600	94	US Utility	European Entity	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.
[3]Price is not normalized to 0.20% tails assay.
[4]Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.
[5]The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2335	400	—	
2740*	100	—	
2777	500	—	
2810	195	175	UF_6
2826*	230	—	UF_6
2933	300	300 per year	
2967*	500	—	
2989*	40	—	
3023	750	500	UF_6
3121*	1,200	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2781*	—	250 per year	1988-95
2927*	—	220 per year	1987-90
TOTAL	4,215		
INACTIVE			
2297*	200	200 per year	1988-89
2336	250	250 per year	1987-94
2389	75	75 per year	1987-90
2703	750	—	
2764	260	—	UF_6
2765	260	—	UF_6
2813*	30	—	
2853	65	—	
2871	50	—	
TOTAL:	2,040		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2778, 2851, 2919.

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CURRENT MARKET DATA

URANIUM DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase: ACTIVE			
2681*	500	500 per year	UF_6 or U_3O_8; 1988
2782*	350	900	1988
2839*	100	—	UF_6
2943	25	—	UF_6
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2738	—	1,000	1989 on
2760	—	750 per year	1987-90
2850	—	300 per year	1990-95
TOTAL:	975		
INACTIVE			
2661	250	250 per year	1986-87
2733	500	500 per year	1987-91
2784	100	—	
2798	70	—	
2845	400	—	
TOTAL:	1,320		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2586, 2770, 2806, 2821, 2858, 2870, 2915, 2930.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859*	750	750	
2988*	400	500	
TOTAL:	1,700		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2974*	165	—	
TOTAL:	565		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: 2717, 2826, 2920, 2925.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2873	40	—	
2914	15	—	
2953	200	—	
TOTAL:	255		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
INACTIVE			
2878*	10	—	
2879*	250	—	
TOTAL:	260		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 3024.

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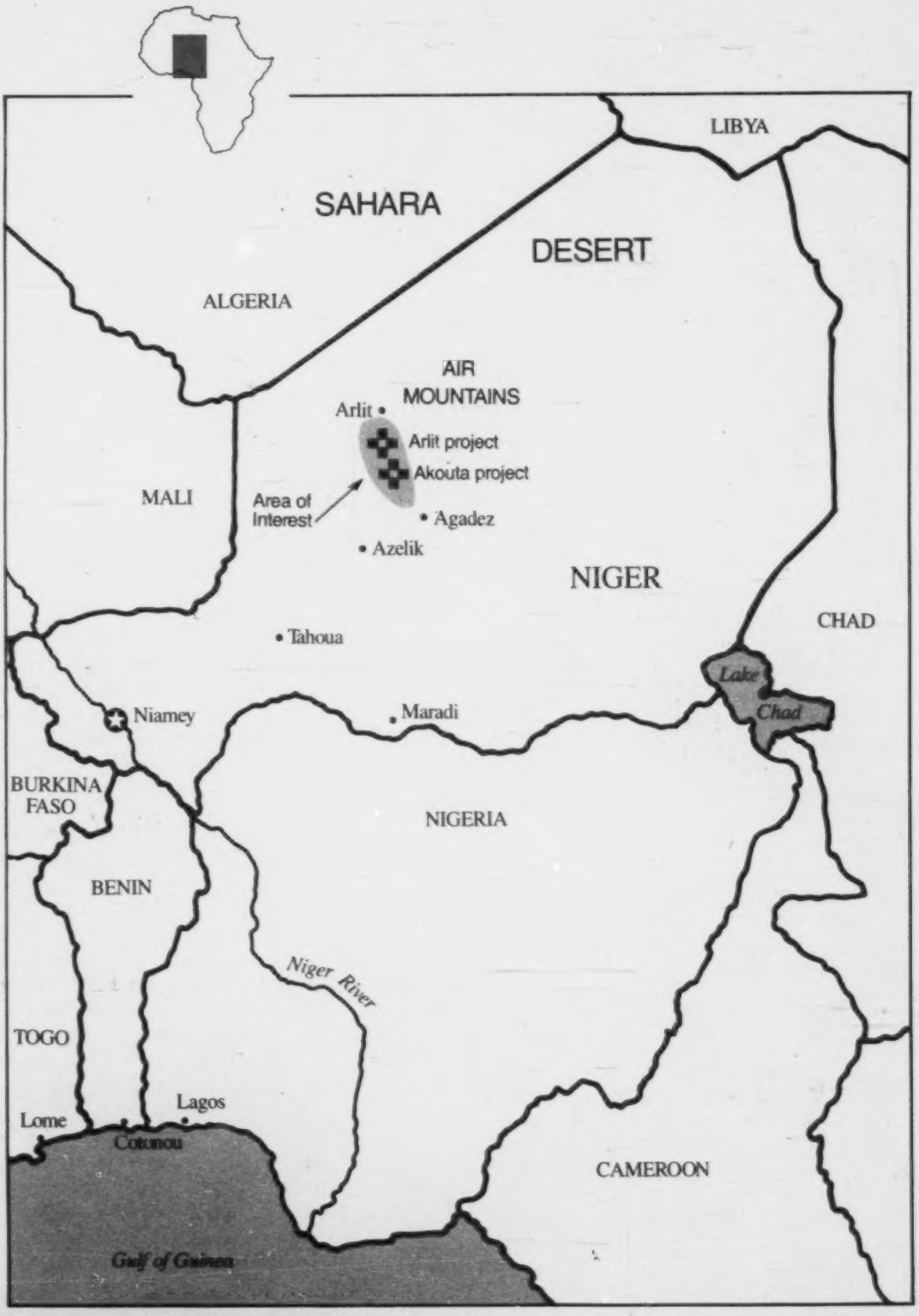

Figure 1. Location map shows operating projects and area of interest for uranium production in Niger.

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Table 1
ORIGINAL AND CURRENT OWNERSHIP OF SOMAIR[1]

Original Shareholder	Country	Percent	Current Shareholder	Country	Percent
Onarem[2]	Niger	33.000	Onarem	Niger	33.000
Cogema[3]	France	26.961	Cogema	France	26.961
CF Mokta[4]	France	19.378	Sogerem[5]	France	19.378
Minatome	France	7.583	UPUK[6]	France	7.583
Urangesellschaft mbH	FRG	6.539	Urangesellschaft mbH	FRG	6.539
AGIP Uranio	Italy	6.539	AGIP Uranio	Italy	6.539
		100.000			100.000

[1]Somair = Société des Mines de L'Air.
[2]Onarem = Office National des Ressources Minière.
[3]Cogema = Compagnie Générale des Matieres Nucleaires.
[4]CF Mokta = Compagnie Francaise Mokta.
[5]Sogerem = Société Générale des Recherches et d'Exploitation Minières.
[6]UPUK = Uranium Pechiney Ugine Kuhlmann.

While Somair's owners determine the following year's production rate, they are not required to purchase any of that output. Thus, the owners have access to long-term uranium supply without having an obligation to buy in any particular year. This has been the chief cause of reduced operations at Arlit, as Cogema and Onarem were the only owners that purchased the production output in 1985; the other owners declined the option to buy Arlit uranium that year. In 1984, only Cogema and Urangesellschaft purchased Arlit output.

Cominak and the Akouta Project

Niger's only other active production site is located at Akouta, 10 kilometers south of Arlit. The underground mine began production in 1978 and has an annual capacity of nearly six million pounds U_3O_8. Production in 1985 totaled 5.2 million pounds U_3O_8, over 60 percent of Niger's output for the year. In general, grades at Akouta are higher than at Arlit. The acid-leach mill has an annual capacity of about 5.7 million pounds U_3O_8.

Cogema has the largest ownership interest in Cominak (Compagnie Minière d'Akouta), as shown in Table 2, and is the project operator. Cominak's administrative structure is similar to that of Somair. Unlike the Somair operation, however, Cominak owners must purchase their percentage share of each year's production. From 1979 to 1982, the mine produced at almost full capacity and all of the owners purchased their shares. Since 1983, the French, Spanish and Japanese owners have purchased all of Cominak's annual production, including Onarem's share; Onarem has not marketed any of its own output. However, the mine has been operating at a slightly reduced rate of 5.2 million pounds U_3O_8 per year. In an effort to increase head grades at the mill, since 1984 Cominak has operated a backfilling and pillar-robbing mining system in high-grade areas that had been mined previously.

Table 2
OWNERSHIP OF COMINAK[1]

Shareholder	Country	Percent
Cogema[2]	France	34.0
Onarem[3]	Niger	31.0
OURD[4]	Japan	25.0
ENUSA[5]	Spain	10.0
		100.0

[1]Cominak = Compagnie Minière d'Akouta
[2]Cogema = Compagnie Générale des Matieres Nucleaires.
[3]Onarem = Office National des Ressources Minière.
[4]OURD = Overseas Uranium Resources Development Corporation.
[5]ENUSA = Empresa Nacional de Uranio SA.

Price Relationship

While most world market uranium prices are quoted in US dollars per pound U_3O_8, the price of Nigerien uranium is quoted in Central Africa Francs per kilogram of uranium (CFA/kgU). The CFA is tied to the French franc (FF) at a constant rate of 50 CFA per French franc. Thus, the fluctuations between the French franc and the US dollar directly affect the CFA/US dollar relationship. To compare the price of Nigerien uranium to US dollar-denominated prices at a given time requires the conversion from KgU to pounds U_3O_8 (2.5998 lbs. U_3O_8 per kgU), the 50 CFA per FF constant, and the French franc to US dollar exchange rate at the time. The following equations illustrate this point.

Assuming the Nigerien uranium price is 30,000 CFA/kgU:

When the French franc/US dollar exchange rate is 9.38 FF/US$, then

$$\frac{30{,}000 \text{ CFA/kgU}}{(9.38 \text{ FF/\$})\,(50 \text{ CFA/FF})\,(2.5998 \text{ lbs. } U_3O_8\text{/kgU})}$$

$$= \textbf{\$24.60 per pound } U_3O_8$$

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When the French franc/US dollar exchange rate is 6.89 FF/US$, then

$$\frac{30{,}000 \text{ CFA/kgU}}{(6.89 \text{ FF/\$})\,(50 \text{ CFA/FF})\,(2.5998 \text{ lbs. } U_3O_8\text{/kgU})}$$

= $33.50 per pound U_3O_8

Thus, the US dollar price of Nigerien uranium at any given time depends upon exchange rates and the strength of the French franc in relation to the US dollar. The 1985 posted price for Nigerien uranium was 30,000 CFA/kgU. On December 31, 1985, the exchange rate was 7.55 FF/$, so that the US dollar price of Nigerien uranium at the end of 1985 was $30.57 per pound U_3O_8; at the same time the Nuexco Exchange Value was $17.00.

Other Projects

Several planned operations and exploration programs were in effect throughout the 1970s and 1980s. Some are idle due to poor market conditions and other reasons, and some exploration programs continue at a reduced pace.

1. *Société de Tassa N'Taghalgue (SMTT).* SMTT was to have been an open pit mine located adjacent to the Somair mine on the Arlit concession. Onarem, Cogema, and the government of Kuwait each own about one-third of SMTT. The project was scheduled to begin production in 1979, but the only work on the project was performed in 1982 and 1983 by Somair staff. There had been reports that Somair operations might be shifted to the SMTT site, but no agreement between Somair and SMTT has been announced. The project remains idle.

2. *Imouraren.* This project was to have been Niger's largest mine. It consists of an extremely large, low-grade deposit amenable to open-pit mining. Mineable reserves reportedly exceed 180 million pounds U_3O_8. The ownership consists of Cogema (35 percent), Conoco Minerals (USA; 35 percent), and Onarem (30 percent). The administrative structure would have been similar to Cominak's; each owner would be obligated to purchase its share of production. Scheduled to begin production in 1982, the project failed to gain final commitments and lingered until 1983 when Conoco abandoned the venture and forfeited its claims to the reserves.

3. *Afasto East.* Located on the Techili concession, this exploration program involves Onarem, Saarburg Interplan Uran (Federal Republic of Germany), Central Electricity Generating Board (United Kingdom), and the government of Nigeria.

4. *Afasto West.* Located south of the Arlit mines, the Afasto West deposits are small, widely scattered, but contain good grades. In 1975, Onarem, Cogema, and OURD (Japan) began exploration, but no economic mines were developed. The partners are delaying any further work until the uranium market strengthens.

5. *Sekiret.* This concession is located south of Arlit and was leased in 1981 to an exploration partnership consisting of Onarem and Power Reactor and Nuclear Fuel Development Corporation [PNC] (Japan). As of 1985 the partners were still planning to continue prospecting on the concession.

6. *Teguidda N'Teesoum (TGT).* Located on the Abakorum concession, TGT reportedly has some 39 million pounds U_3O_8 of reserves. Formed in 1975 by Onarem and International Resources, SA [IRSA] (Japan), its exploration permit was renewed in 1984.

Outlook

Cogema currently purchases over half of the output from both the Cominak and Somair operations, and may continue to do so through the 1980s. Cominak's owners appear to be committed to maintaining the current production level, so output should remain constant into the 1990s. Recently, however, some of Somair's owners, who are not required to purchase their respective shares of the output, have chosen not to do so. Somair's declining production, currently supported by Cogema purchases, may lead to a shutdown of operations by the 1990s, reducing Niger's production to slightly more than five million pounds U_3O_8 annually. Moreover, until the uranium market strengthens significantly, the future of planned projects in Niger is uncertain.

The problems for Niger as a supplier nation in a weak uranium market have been compounded by the effects of inflation, general weakness of the French franc during the early 1980s, and a pricing policy that is unrelated and unresponsive to spot market realities. While this situation may be acceptable to owners/customers whose primary concern is long-term supply, it has effectively inhibited near-term sales in the world market. For these reasons, Onarem's periodic attempts to market its share of production to customers other than the co-owners have met with limited success. Recently, however, there have been some indications that past policies may be reconsidered and steps may be initiated that would result in higher ore grades, reduced costs, and more flexible pricing arrangements. Without such efforts, Niger's production will remain a function of how its investors value captive production from Niger compared to other sources available in the world market.

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AUSTRALIA

In an unexpected turn of events at the end of May, the proposed transaction under which Pioneer Concrete Services Ltd. would have purchased North Broken Hill's 30-percent equity interest in ERA was canceled. (See Report 213, May 1986). One day later, Pioneer Concrete itself became a target of a take-over attempt mounted by FAI Insurances, Ltd., the financing vehicle utilized by Mr. Lawrence J. Adler. The reasons for the collapse of the Pioneer-North Broken Hill deal are not entirely clear as of press time, but some factors are apparent. It was not clear whether certain rights of first refusal would be transferred to Pioneer upon its purchase of the North Broken Hill shares. Lacking such rights, Pioneer could find itself locked into a minority position in relation to Peko Wallsend (PEKO), the other major ERA shareholder. Such a possibility was undoubtedly seen as unacceptable by Pioneer. Complicating this situation is a reported power struggle within ERA involving PEKO's attempts to gain increased control and the reported reluctance of ERA's foreign customer/shareholders to see PEKO gain such control.

The Australian financial community generally believes that North Broken Hill must dispose of its interest in ERA, but in question is what entity will acquire that interest. There are also reports that PEKO wishes to gain majority control of ERA, and, with the effective power to block purchase by others, is itself considering the acquisition of North Broken Hill's shares, albeit at a lower price. Equally uncertain at this time is the future of Pioneer Concrete and that of Queensland Mines, viewed as one of Pioneer's more valuable holdings.

* * *

In early May, the Olympic Dam (Roxby Downs) joint venture partners, Western Mining Corporation and the BP Group, took the final step in the initiation of the Olympic Dam project, by issuing the formal advice to the government of South Australia of their intent to proceed with the project as required under the Roxby Downs Indenture Ratification Act of 1982. The only change from their December 1985 decision to commit was the announcement that a $40 million copper refinery would be built and that the copper product would be in the form of cathode rather than blister, as previously planned. Aggressive marketing of the uranium production continues, and while no supply contracts have yet been announced, reports persist that at least one letter of intent is in place and that discussions with other potential customers are in progress.

* * *

In Report 212 (April 1986), Nuexco noted that Energy Resources of Australia (ERA) faced a potentially serious legal challenge to the validity of its permit for its Ranger mining operation in the Northern Territory. The High Court of Australia, however, has ruled that the amendment to the Atomic Energy Act of 1980, under which ERA mines the Ranger deposit, is indeed valid. The Northern Land Council, an Aboriginal body, had challenged the amendment in an apparent attempt to exert more control over ERA and its operations, but the Court's ruling appears to settle the matter totally in favor of ERA. The amendment provides that ERA could carry on operations at Ranger as if done on behalf of and authorized by the Australian government.

THE NETHERLANDS

In recent parliamentary elections, the government of Prime Minister Ruud Lubbers, part of a center-right coalition of Christian Democrats and Liberals, unexpectedly emerged with the same majority of seats in the Dutch parliament as it held after the last election in 1982. The fate of nuclear power in the Netherlands, particularly the future of two planned units, may be closely tied to the results.

In the wake of the Chernobyl accident, opinion polls reflected a noticeable shift in the Dutch public's view of nuclear power and predicted the incumbent government's defeat by the moderate left, namely the Labor Party. Prime Minister Lubbers and his coalition government had modified their views on nuclear power prior to the election, suddenly postponing plans to build two new reactors. Despite that action, support for the Labor Party, which was campaigning on a platform calling for the abandonment of nuclear energy, increased following the Chernobyl accident. A Labor Party victory would have almost certainly signalled a total retreat from nuclear power in the Netherlands, where utilities have been hindered by anti-nuclear politics since the mid-1970s.

In a debate prior to the election, the Prime Minister assured voters that the future of nuclear power was uncertain until safety questions raised by the Chernobyl accident were answered. The incumbent government managed to secure 81 seats in the 150-seat parliament, and although the Labor Party made some progress, gaining about five seats, it conceded defeat only one hour after the polls had closed. Its gains mostly came at the expense of smaller parties. Voter turnout was reported to be very large.

Considering the unexpected vote of confidence given to Prime Minister Lubber's government and its policies, it is likely that the plans to install 2,000 MWe of nuclear generating capacity by 1995 eventually will proceed, perhaps after safety studies are concluded. In June 1985, parliament approved the cabinet plan to build more nuclear units, and it approved the government's site recommendations for the new units in January 1986. The preferred site is at Borssele, where the Netherlands' largest existing nuclear unit has been operating since 1973.

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RECENT DEVELOPMENTS

UNITED STATES

The Financial Accounting Standards Board (FASB), a private-sector body, has proposed changes in the accounting procedures used by electric utility companies for the effects on their revenues of rate-making decisions by public utility commissions. The seven-member panel consists of senior accountants appointed by trustees of the Financial Accounting Foundation. Standards promulgated by the FASB, primarily in the form of "Statements of Financial Accounting Standards," are recognized as authoritative policy for financial reporting in the private sector.

The proposed Statement, issued by the FASB in December 1985 in the form of an "Exposure Draft" for public comment, will be the subject of a public hearing to be held June 4-6, 1986. More than 70 organizations and individuals, a record number of participants, will testify at the hearings. Opponents of the proposed revision believe that it could well cause the financing of nuclear construction projects to become prohibitively expensive. Some 21 utilities have formed a group called the Committee for Consistent Accounting Practices (CCAP) to lobby the FASB to reconsider the proposed changes at the upcoming hearing. The FASB adopted the exposure draft in December by only a 4 to 3 vote, so sufficient opposition could influence the outcome.

The changes proposed in the "Exposure Draft" of the proposed Statement relate to three specific issues that have increased in importance in the electric utility industry since 1982, when the FASB issued its Statement of Financial Accounting Standard No. 71, entitled "Accounting for the Effects of Certain Types of Regulations." Those issues are

— plant cost "phase-in plans;"

— abandonments of operating assets (plants) or assets under construction;

— disallowance of plant costs for rate-making purposes.

Each of these areas are of significant importance to the electric utility industry, especially utilities having nuclear units, in view of the enormous costs involved in the construction of nuclear power plants.

Among other measures, the proposed changes, if adopted, would affect the financial accounting treatment of the three events in the following manner:

1. *Phase-in of new plant costs.* The costs associated would be capitalized provided that the phase-in plan (to defer costs for recovery through the rate process in future years) has been approved by the applicable regulatory authority, the duration of the recovery period to recognize such deferred costs is specified in the plan, and all deferred amounts are to be recovered within ten years of the plan's inception.

2. *Plant abandonments.* The book value of an abandoned plant would be presented (for financial statement purposes) at the lesser of its costs *or* the present value of probable future revenues allowed for rate-making purposes by the appropriate regulatory authority. Any excess of current book value over the amount determined above would be recognized as a loss in the period when realized.

3. *Disallowances.* It would require any disallowed costs of a newly completed plant to be recognized as a *current period loss* on the utility's financial statements.

During 1984, rate problems related to new nuclear electric generating plants of several utilities were widely discussed in the financial press. Rising costs of nuclear plant construction, often totaling billions of dollars, were especially prominent. At question was whether the utilities could establish rates based on the cost of those plants without losing a major part of their customer base. Some articles indicated that phase-in plans were likely for certain of those utilities, but they raised significant questions about the assurance of cost recovery in future periods. Representatives of some regulatory commissions began to question the cost of some of those new plants and to discuss possible major disallowances. Also, several plants in advanced stages of construction were abandoned. In a few states, courts ruled that utilities could recover the costs of those abandoned plants from customers.

When a utility completes a new plant, current accepted rate-making procedures provide for the recovery in allowed rates of the current operating costs of the plant, including depreciation, interest, and a fair rate of return on shareholders' investment. In recent years, however, the cost of constructing new plants has been much greater than in the past, and conventional rate-making procedures often have resulted in significantly increased rates for some utilities. Phase-in plans were designed to mitigate the effects of such sudden "rate shock." Part of the current operating costs related to a new plant that normally would be recovered through current rates were deferred for recovery in future years by utilizing phase-in plans, which were not specifically addressed in Statement No. 71 when it was issued in 1982.

The Exposure Draft would affect most of the utilities which have brought nuclear-generating plants into operation in the last few years and have faced rigorous cost prudency hearings from public utility commissions. The position on those issues, when finally adopted by the FASB in a Statement of Financial Accounting Standards, may well establish a pattern regarding the appropriate accounting for rate-regulated utilities in all regulatory jurisdictions, as well as for the recovery of long-lived assets outside the regulatory environment.

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The Exposure Draft would be effective for fiscal years beginning after December 15, 1986 and would apply to:

— existing and future phase-in plans,

— recorded costs of previously abandoned assets and of assets for which abandonment is probable in the future,

— previously disallowed plant costs and disallowances of plant costs that are probable in the future.

Restatement of financial statements for prior fiscal years would be permitted but not required. Because the proposed changes would apply retroactively, however, many utilities strongly oppose the amendment, emphasizing that utilities that financed plant construction projects under existing procedures should not be penalized by a revision of those procedures. Due to the large capital costs and demonstrated financial risks associated with nuclear plant construction, many utilities fear that such new accounting procedures, if adopted, would effectively prohibit the nuclear option for future plant additions.

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AMPLIFICATIONS

In the article on World Uranium Production in Report 213 (May 1986), a reference was made to an expected increase in production at "Saskatchewan Mining Development Corporation's Key Lake operation." In actuality, the Key Lake project is operated by Key Lake Mining Company, which is owned by SMDC (50 percent), Uranerz Exploration and Mining (33.3 percent), and Eldor Resources Limited (16.7 percent).

Two items in the 1985 Annual Review, published in March 1986, warrant correction.

1. In the article on Spain (page 35), the reasonably assured resource figure of 35 million pounds U_3O_8 is erroneous. Table 3 separates Spain's Reasonably Assured Resources (RAR) and Estimated Additional Resources (EAR) by cost category, demonstrating that RAR recoverable at costs less than $80 per kgU total 26,700 metric tons U, or 69 million pounds U_3O_8. Total RAR exceed 85 million pounds U_3O_8.

2. In Figure 5 on page 30, entitled "German Ownership in Active Uranium Production and Trading Operations," the ownership percentages shown for Steag AG are incorrect. Neither RWE, VEW, nor Veba AG have any *direct* ownership interest in Steag. Rather, their interests in Steag are held through their ownership of two companies that in turn own over 95 percent of Steag. These relationships are detailed in the top portion of Table 4. The bottom portion of the table indicates the *net effective* ownership interests in Steag. Figure 2 shows the revised German ownership percentages.

Table 4

OWNERSHIP OF STEAG AG AND ITS PRINCIPAL SHAREHOLDERS

Shareholder		Percent
Ruhrkohle AG		71.08
Owned by		
Veba AG	37.1	
BGE[1] (subsidiary of VEW[2])	21.7	
Thyssen Stahl AG	12.7	
Montan Verwaltungsgesellschaft mbH	10.0	
Verwaltungsgesellschaft Ruhrkohle-Beteiligungs mbH	10.0	
Societe Nouvelle Sidechar	8.3	
Gewerkschaft Alte Haase	0.2	
	100.00	
Gesellschaft fuer Energiebeteiligung mbH		25.84
Owned by		
RWE[3]	44.6	
Veba Kraftwerke Ruhr AG (subsidiary of Veba AG)	29.1	
Veba AG	26.3	
	100.0	
Other Shareholders		3.08
		100.00
Net Effective Ownership in Steag AG		
Veba AG	40.69	
VEW	15.42	
RWE	11.53	
Other	32.36	
	100.00	

[1]BGE = Beteiligungsgesellschaft fuer Energieunternehmen mbH.
[2]VEW = Vereinigte Elektrizitaetswerke Westfalen AG.
[3]RWE = Rheinisch-Westfaelisches Elektrizitaetswerk AG.

Table 3

URANIUM RESOURCE ESTIMATES IN SPAIN[1]
Metric tons Uranium
(Pounds U_3O_8)

Reasonably Assured Resources (RAR) Recoverable at Costs		Estimated Additional Resources (EAR) Recoverable at Costs	
Less than $80/kgU	**Between $80/kgU and $180/kgU**	**Less than $80/kgU**	**Between $80/kgU and $180/kgU**
26,700	6,200	9,000	—
(69,415,000)	(16,120,000)	(23,400,000)	—

[1]SOURCE: Empresa Nacional del Uranio, S.A. (ENUSA).

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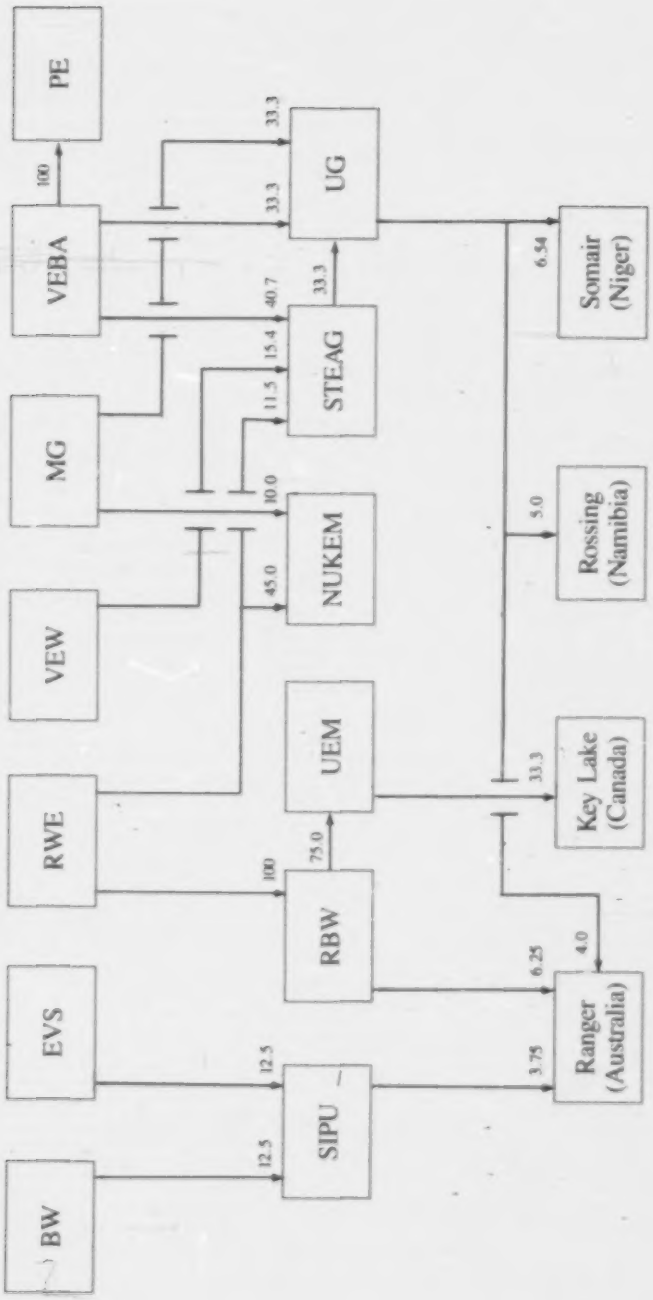
Figure 2

GERMAN OWNERSHIP IN ACTIVE URANIUM PRODUCTION AND TRADING OPERATIONS



BW — Badenwerk AG
EVS — Energieversorgung Schwaben AG
MG — Metallgesellschaft AG
NUKEM — Nukem GmbH
PE — Preussenelektra AG
RBW — Rheinische Braunkohlenwerke AG
RWE — Rheinisch-Westfaelisches Elektrizitaetswerk AG
SIPU — Saarberg Interplan Uran GmbH
STEAG — Steag AG
UEM — Uranerz Exploration & Mining Co.
UG — Urangesellschaft mbH
VEBA — Veba AG
VEW — Vereinigte Elektrizitaetswerk Westfalen AG

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RAW MATERIALS

GEOLOGIC CLASSIFICATIONS OF URANIUM DEPOSITS

The following article gives an overview of the manner in which uranium deposits worldwide are classified for exploration and mining purposes. It may serve as a reference guide for different types of uranium mineralization.

Introduction

Uranium is a minor but widespread constituent of the earth's crust. Through the normal processes of geologic change, concentrations of uranium have formed various types of deposits in several different geologic environments. There is considerable differentiation in the characteristics of those deposits, particularly in size, uranium content, genesis, and geologic environment. Because the size and uranium content in a given deposit are subject to uncertainty, the classification of uranium deposits is usually based on genesis and geologic environment.

The classification of uranium deposits has evolved over time. Usually, a scientific body or an international study group attempts to reclassify and further define uranium occurrences, and the results are published for dissemination throughout the mining and exploration industry. Joint publications by the OECD Nuclear Energy Agency and the International Atomic Energy Agency (IAEA), favor the listing of uranium deposits by *geological setting*.[1] Accordingly, world uranium resources have been categorized by type of deposit in one of six specific geologic settings:

1. Quartz-pebble conglomerate deposits;
2. Proterozoic unconformity-related deposits;
3. Disseminated magmatic, pegmatitic and contact deposits in igneous and metamorphic rocks;
4. Vein deposits;
5. Sandstone deposits;
6. Other types of deposits.

Resources in the first five categories need little explanation, as some of the largest, best-defined and exploited deposits fall into these categories. The sixth category includes resources occurring in calcretes, limestones, marine phosphorites, bituminous shales, lignites, and volcanic rocks. These six geologic settings are widely recognized and commonly noted in scientific literature.

The US Department of Energy (DOE), through the National Uranium Resource Evaluation (NURE) program formulated a more detailed procedure for the classification of uranium resources.[2] Based on *ore genesis* and geologic environment, all deposits are assigned to one of the following four categories:

A. Deposits in sedimentary rocks
B. Occurrences in and related to plutonic igneous rocks
C. Volcanogenic uranium deposits
D. Uranium deposits of uncertain genesis.

The fundamental characteristics of the four categories expand on theories of ore genesis within a given geologic environment. Category A details ore genesis in all types of sedimentary rocks, category B is based on the ore-forming process as related to the evolution of igneous rocks, category C deals with staged ore-forming processes associated with a volcanogenic system, and category D describes vein-type deposits related to metamorphic and sedimentary rocks as well as unconformity-related deposits. Deposits in category D are so listed because of the uncertain genesis of associated ore minerals.

Figure 3 illustrates the relationship between the main categories and subgroupings that are used in the NURE system of classification. However, both classification systems are based on the categorization of uranium deposits into easily identifiable groups. Each permits a rapid interpretation and understanding of uranium deposits and establishes a functional relationship between past and future exploration experiences, allowing a better approach for the recognition and evaluation of new exploration projects.

The classification of uranium deposits herein considers both the IUREP and NURE outlines, but the format follows that of the NURE system. It offers a fundamental classification of all types of deposits within a particular geologic environment relative to ore genesis.

A. Deposits in Sedimentary Rocks

Uranium mineralization is known to occur from trace amounts up to million-pound concentrations in at least nine different sedimentary environments. Essentially, the ultimate source of uranium within each environment is considered to be uranium-bearing igneous rocks, but methods by which the uranium was concentrated are divided into two groups: syngenetic deposits formed contemporaneously with deposition of the host sediment, and epigenetic deposits formed by the precipitation of uranium from solutions migrating through a preexisting sedimentary sequence. The origin of solutions can be any combination of interstitial water, surface sources, or hydrothermal solutions emanating from greater depth.

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[1] "Uranium Resources, Production and Demand," December, 1983; and "World Uranium Geology and Resource Potential," by the International Uranium Resources Evaluation Project (IUREP) a joint steering group sponsored by OECD and IAEA, Report on phase 1, page 39, 1980.

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[2] "A preliminary classification of uranium deposits," GJBX-63(78), prepared for DOE by Bendix Field Engineering Corp. (BFEC), May 1978. "Geologic characteristics of environments favorable for uranium deposits," GJBX-67(78), prepared for DOE, by BFEC, 1978.

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GEOLOGIC STRATIGRAPHIC COLUMN			A. Uranium in sedimentary rocks	B. Uranium in plutonic igneous rocks	C. Volcanogenic uranium deposits	D. Uranium deposits of uncertain genesis
ERA	SYSTEM	SERIES (EPOCH)				
Cenozoic	Quaternary	Recent	1,7			
		Holocene				
		Pleistocene				
	Tertiary	Pliocene	6			
		Miocene	7		1,2 3,4	
		Oligocene				
		Eocene	9			
		Paleocene	9			
Mesozoic	Cretaceous		1,6	1,2,3 4,5,6,7		
	Jurassic		9			
	Triassic		8,9			3
Paleozoic	Permian		4			3
	Pennsylvanian					3
	Mississippian					3
	Devonian		3			
	Silurian					
	Ordovician					
	Cambrian					
Precambrian	Proterozoic	Upper Lower	2	3,7,8		1,2
	Archean		2			1,2

LEGEND

A.	B.	C.	D.
1. Placer deposits	1. Orthomagmatic	1. Initial-magmatic	1. Unconformity-related
2. Quartz-pebble conglomerates	2. Pegmatitic and aplitic	2. Pneumatogenic	2. Vein-type deposits in metamorphic rocks
3. Marine Black Shales	3. Magmatic-hydrothermal	3. Hydrosauthigenic	3. Vein-type deposits in sediments
4. Phosphorite	4. Contact-metasomatic	4. Hydroallogenic	
5. Seawater	5. Autometasomatic		
6. Lignite, coal, carbonaceous shales	6. Authigenic		
7. Evaporative precipitates	7. Allogenic		
8. Limestone	8. Anatectic		
9. Sandstone			

Figure 3. Stratigraphic distribution of uranium deposits by classification categories.

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Syngenetic deposits occur in five different types of sediments:

1. Placer deposits are described as modern fluvial and beach deposits. Fluvial placers develop in mountain streams and related ponds. If present, uranium is usually associated with thorium minerals, monazite and zircon, all of which are part of the heavy mineral suite in a poorly sorted matrix of fine to medium-grained gravels. The source of mineralization is a highland igneous complex. These deposits are small and almost exclusively limited to the peripheral limits of the Idaho Batholith district. There are no commercial uranium deposits associated with modern fluvial placers.

Beach deposits form along the ocean shorelines as well-sorted, fine-grained heavy mineral stringers interbedded with clean fine-grained quartz sand. Source and occurrence of mineralization is the same as for fluvial deposits. Modern placers exist off the coast of Egypt, Brazil, India and Florida, and fossil placers in the western USA also contain uranium. Beach deposits mined for rutile, monazite and zircon may yield small quantities of by-product uranium.

2. Quartz-pebble conglomerates are placer-type deposits that represent one of the principal resource categories. Known uranium-bearing quartz-pebble conglomerates of considerable economic importance are found in the Witwatersrand complex of South Africa, and in the Elliot Lake/Blind River district of Ontario, Canada. The conglomerate deposits differ from other sedimentary deposits in that they are limited to Lower Proterozoic strata and are in unconformable contact with Archean basement rocks. Further, they are highly pyritic, may be slightly metamorphosed, and contain detrital uranium minerals.

Uraninite and brannerite occur in the Ontario deposits, and uraninite occurs at Witwatersrand. Uranium is associated with a heavy mineral suite which includes important gold values at Witwatersrand, where uranium is produced as a co-product or by-product of gold. In both districts, the greatest concentration of minerals occur near the base of interbedded conglomoratic beds (known as *reefs* at Witwatersrand). The heavy minerals are finely disseminated throughout the favorable zone. A pattern of mineral distribution and segregation is apparent due to the density and size of the particles.

The source of the ore-bearing conglomerates is primarily fluvial. The uranium minerals have been present during the depositional sequence of the quartz-pebble matrix, forming into "orebodies" by the normal process of mechanical separation of the heavy minerals. Typically, the quartz-pebble conglomerates contain low values of uranium. The uranium content varies throughout each district, averaging about 0.10 percent U_3O_8 per ton in Ontario and 0.015 percent in Witwatersrand. Sub-economic uraniferous quartz-pebble conglomerates exist in Brazil and India.

3. Marine Black Shales occur in the stratigraphic section with siltstones, limestones and other shales of Paleozoic age. The black shales containing a high percentage of organic matter, pyrite (or marcasite) as thin stringers or nodules, or phosphate as thin nodules, are usually uraniferous. Contained uranium was probably extracted from seawater upon contact with each constituent during the depositional sequence. Usually, the uranium content averages less than 0.005 percent U_3O_8. However, uranium values show an increase as the content of organic material and phosphate nodules increase.

Uranium recovery from black shales has been performed only on an experimental basis, as opposed to a commercial basis. However, the shales often contain low-grade values of other metals, including copper, chromium, manganese, molybdenum, phosphorous, titanium, vanadium, and kerogen, a petroleum constituent. The recovery of other minerals as co-products is likely to be an important consideration in the economics of producing uranium from a black shale deposit.

Two black shale occurrences have been studied for commercial development of uranium and companion minerals. The Ranstad shale at Billingen, Sweden was considered during the mid-1970s, but the project was abandoned as uneconomic. The Geological Survey of Sweden estimated the vast shale deposit contains approximately 390,000 tons U_3O_8 at an average grade of 0.025 percent. The Chattenooga black shale deposit covers about 35,000 square miles of Tennessee, Kentucky and Alabama. The Gassaway Member of the deposit (upper 11 to 18 feet) contains the important mineral suite. The technology exists for the recovery of uranium, syncrude, ammonia and sulfur from the shale, but high costs preclude its development. Resource estimates for the study area indicate the presence of over 8 billion tons of mineralized shale.

4. Phosphorite consists primarily of the phosphatic mineral carbonate-fluorapatite, usually in the form of laminae, oolites and nodules. Uranium replaces the calcium in the carbonate-fluorapatite lattice. The oxidized portion of a phosphorite deposit, may have a uranium content of 0.005 to 0.020 percent; the grade tends to increase as phosphorite values increase. Uranium is recovered as a by-product to phosphoric acid in several operations located in Florida and one in Louisiana. Its recovery from developing phosphoric acid projects in Morocco and Israel is a possibility in the near future. Generally, phosphorite deposits worldwide have the same approximate uranium content, and they represent an extremely large potential source of low-grade uranium.

5. Seawater has low uranium values, measured at 3 to 10 parts per billion (ppb). The technology exists for the recovery

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of uranium from seawater, but it remains unrealistic considering present economic circumstances. (Nevertheless, Metal Mining Corporation of Japan has constructed an experimental plant to recover uranium from seawater. The model plant has the capacity to produce 10 kg of uranium per year.) However, certain groundwater sources and hot springs contain low-grade uranium that possibly could be recovered through ion-exchange techniques. Presently, uranium is recovered from mine waters using this method.

Epigenetic deposits occur in four sedimentary environments, including the resource base in sandstone formations. The remaining three types of occurrences are usually small and have only limited economic potential.

6. Lignite, coal and carbonaceous shales often contain uranium in low-grade quantities of about 0.005 to 0.01 percent, but in places the uranium content may approach 0.50 percent or higher. In the only attempt to recover uranium from such sediments, lignite was burned or retorted to drive off combustible carbonaceous material, leaving concentrated uranium in the ash. The uranium was eventually recovered from the ash by conventional methods. The source of contained uranium was precipitation and adsorption by the humates from uraniferous groundwater. The fact that the uranium is confined to a thin upper portion of the carbonaceous bed supports the theory of its origin.

No discrete uranium minerals have been identified, but secondary minerals such as meta-autunite and metatyuyamynite may occur in highly oxidized zones. Uraniferous coal sediments are limited primarily to the Fort Union Formation in the Williston Basin, North Dakota (where the lignite was burned) and the Wasatch Formation in the Red Desert of southern Wyoming.

7. Evaporative precipitates are usually classified as surficial uranium deposits, of which the calcrete deposits in Australia and Namibia are considered to be the most important resource. In each location, uranium weathered from granites was carried by surface or groundwater to a favorable host environment where evaporation and precipitation of uranium occurred. Mineralization is usually low in grade, averaging about 0.15 percent, with scattered zones of higher-grade material. Vanadium is usually a companion mineral to carnotite, the main uranium mineral. The age of calcrete deposits is late Tertiary.

Uranium mineralization that occurs in recent sediments (10,000 years ago and less), is so young that daughter products have not formed and radioactivity is nonexistent. Chemical analysis of samples is necessary to detect the presence of uranium. Overall, deposits in this classification represent a potential uranium resource, especially the Tertiary deposits which are well-defined and available for exploitation.

8. Limestone is host to only a few uranium deposits. The Todilto Limestone in the Grants Mineral Belt of New Mexico has been extensively mined in the past. It represents the largest resource base in that environment. The Todilto is fine-bedded with abundant vertical fractures associated with anticlinal structures. Uraniferous solutions entered fractures where uranium concentration occurred. The main uranium mineral is uraninite; secondary minerals of tyuyamunite and uranophane are common in shallow deposits. Mined deposits varied in size from several hundred tons to 50,000 tons or more, averaging 0.15 to 0.25 percent U_3O_8. The Todilto is essentially mined-out along the main mineral trend, but additional potential exists at greater depth.

Limestone uranium deposits have also been mined in the Bighorn and Pryor Mountains in Wyoming and Montana, and at Tyuya-Muyun, USSR. It occurs in filled caves, fissures, and solution channels. A small amount of uranium has also been mined from the limestone portion of the La Domitila deposit in Chihuahua, Mexico.

9. Sandstone is host to a variety of major uranium deposits scattered through several eras of geologic time. Sandstone host rock favorable to uranium deposits is generally of fluvial origin, consisting of medium to coarse-grained to conglomeritic quartz and arkosic material. Pyrite may be scattered throughout and concentrated along bedding planes, but the presence of mudstone lenses, thin stringers, and abundant organic debris are important constituents. Very few deposits occur in sandstones of marine origin.

Uranium accumulation occurs by precipitation from groundwater in a reducing environment. The mudstone and indurated sandstone layers form a barrier to the movement of highly oxidized mineral-bearing solutions. The organic matter and pyrite act as reducing agents, and hydrogen sulfide acts as one of the main reductants during uranium precipitation. It forms during the anaerobic destruction of organic matter and the oxidation of pyrite.

Uraninite and coffenite are the main uranium minerals present, and secondary minerals include carnotite, tyuyamunite, autunite and torbernite. The source of mineralization is uncertain, but could be from granitic rocks or tuffaceous sediments. In either scenario, uranium was leached from the source rock by migrating solutions. Hydrothermal solutions may have been the source of uranium in older deposits adjacent to prominent structural features.

Epigenetic sandstone deposits occur in three categories, each characteristic of the surrounding host environment. The

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three categories are stratiform, roll-type and vein-type deposits. (Vein-type deposits can occur in a wide variety of host rocks and genetic sources, so they are included in the last major classification section.) Stratiform deposits represent the largest uranium resource base in the USA. The deposits are tabular and usually elongated with the depositional trend of the formation. Stratiform deposits occur in the Chinle Formation of Triassic age in the Uravan Mineral Belt of Utah and Colorado, and in the Morrison Formation of Jurassic age in the Grants Mineral Belt, New Mexico. Important deposits also occur in the Wind River and Wasatch Formations of Tertiary-age in the basins of Wyoming.

Roll-type deposits occur in Tertiary channel sediments of the intermontane basins of Wyoming and coastal-plain environment of South Texas. Uranium deposition has occurred at the chemical boundary (solution front) between altered and unaltered zones within host sediments. A typical solution front forms as oxidizing solutions migrate and advance in a sinuous pattern through unaltered sediments. Uranium precipitates at the redox line to form C-, O- and S-shaped ore deposits. Roll-front mineralization may be associated with stratiform deposits, as in the Mount Taylor deposit of the Grants Mineral Belt.

B. Deposits in Plutonic Igneous Rocks

There are eight classes of uranium occurrence identified with *plutonic igneous rocks*. The classification system is somewhat theoretical because of a general lack of conclusive evidence regarding orthomagmatic stages (crystallization) of plutonic igneous rocks. Uranium concentration closely follows the process of magmatic evolution of the host rocks. Uranium is oxidized during the magmatic process and may be completely removed from the igneous environment, or concentrated during differentiation or recrystallization of the host material. Igneous rock characteristics, and the predicted behavior of uranium mineralization, can be segrated into identifiable criteria for field and laboratory evaluation.

1. Orthomagmatic occurrences are identified with regional tectonic deformation. Plutonic host rocks are highly granitic to syenitic, with a porphyritic texture. Metamorphism, accompanied by local metasomatism, may occur along contacts with intrusive dikes and zones where abrupt segregation of rock-forming constituents has occurred. Uranium-bearing minerals present include thorium, zircon and monazite. Primary uranium minerals are uncommon, but if present, uraninite will be the main mineral and coffinite occasionally will occur.

The Bokan Mountain deposit on the panhandle of Alaska may represent the largest deposit of this type. Uranium and uranium-bearing minerals are concentrated in the youngest of two intrusive magma series of Late Cretaceous age. The mineralization shows zonal dissemination within the granite. Several million pounds of U_3O_8 were mined during the late 1950s and early 1960s. A second location is along the Front Range of Colorado (near Central City), where a series of bostonite dikes intruded Precambrian metasedimentary rocks during Late Cretaceous time. Uranium mineralization occurs in association with zircon, thorite and allanite. The source of mineralization is thought to be hydrothermal solutions. The occurrence is small and probably lacks economic value.

2. Pegmatitic and aplitic uranium occurrences apparently form during the process of magmatic differentiation and segregation of pegmatitic fluids during the final stage of intrusion. Such occurrences show concentration along the margins of uranium-rich granitic masses, and in some cases, the dikes may intrude the country rock. Uraninite and the uranium-bearing minerals of uranothorianite, brannerite and allanite will be disseminated throughout the dike material. Zoning of mineralization in pegmatites is common, in which case concentrations of high-grade uranium may occur.

Bokan Mountain in Alaska is host to pegmatite and aplite dikes intruded into the Bokan Mountain granite. Allanite is the major uranium-bearing mineral present. Uraninite occurs in isolated zones of quartz segregation. Pegmatitic uranium is also common to the Bancroft area of Ontario. At the Bicroft mine, pegmatites were intruded into the Centre Lake granite where it makes contact with metasediments. Uranium is associated with the dikes in the form of uraninite, uranothorianite, allanite and betafite. Production has been initiated at several occurrences in the district.

3. Magmatic-hydrothermal uranium evolved from hydrothermal solution activity during the final stage of magmatic differentiation in a uranium-rich country rock. Shear and fracture zones associated with faulting are the host environment for the development of mineralized veins. The primary uranium minerals filling the veins are uraninite and pitchblende, with small amounts of coffinite and brannerite. Uranium deposits of this class occur at Radium Hill, Australia. Davidite is the primary uranium mineral present in fractures and shears confined to Archean and Lower Proterozoic metasediments.

4. Contact-metasomatic uranium occurrences have formed along shear and fracture zones associated with structural deformation at the contact between uranium-rich intrusive bodies and stable country rock. Uraniferous solutions present in late-stage hydrothermal activity, which may be in association with the intrusion of pegmatites, show uranium con-

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centration in veins and pods along the contact. Uranium enrichment into the country rock occurs through dissemination and metasomatism. The important uranium and uranium-bearing minerals are uraninite and thorianite.

The Mary Kathleen deposit located in Queensland, Australia is representative of this class. Uraninite mineralization shows metasomatic enrichment along the contact zone between calcareous metasediments and two intrusive granitic bodies. The main ore deposits are closely associated with faulting and brecciation in the metasediments. Almost 9,000 tons U_3O_8 have been mined and recovered from the Mary Kathleen deposit.

5. Autometasomatic uranium occurrences have formed from the interaction of late-stage hydrothermal solution activity upon previously crystallized plutonic rock. The solutions introduced along shears and faults brought in new uranium and caused remobilization of existing uranium to form enriched zones in-place or in adjacent environments. The mineral concentrations occur in fracture and breccia zones where albitized and chemically altered zones prevail.

This class deposit also exists at Bokan Mountain in Alaska, where uranium minerals are concentrated along graditional contacts with the host granites. The composition of the Kaffo Valley granite in Nigeria is similar to the Bokan Mountain granite. It also contains enriched uranium zones in albitized alteration, but those deposits have not been exploited.

6. Authigenic uranium occurrences are formed by the redistribution and concentration of uranium within the original igneous complex. Uranium minerals tend to concentrate along shears and fractures where rock alteration is more pronounced. The concentration of uranium is related to the degree of rock alteration and intensity of weathering. The downward extent of the mineralization is apparently related to groundwater levels. Autunite is the main uranium mineral present.

The Daybreak mine located on Mount Spokane, Washington falls under the authigenic class. Uranium has accumulated along a horizontal shear zone in a host of porphyritic quartz monzonite intruded at different locations by biotite pegmatites. Vertical shears confined to the upper portion (hanging wall) of the main zone are also mineralized. The main uranium mineral is meta-autunite. The deposit has been extensively mined.

7. Allogenic uranium occurrences formed as a result of remobilized uranium being transported away from source rocks and reconcentrated in a new environment. The new accumulations are usually limited to highly fractured and brecciated rock. Pitchblende is the primary uranium mineral present; uranophane may be present as a secondary mineral.

The Midnight mine located 40 miles northeast of Spokane, Washington is considered an allogenic deposit. The uranium is concentrated in a number of step faults and shears in metasediments covering a portion of a quartz monzonite intrusion. Pitchblende and uranophane are common to the deposit; autunite occurs in highly altered rock on the surface. The Nabarlek deposit in the Northwest Territory, Australia is another example of allogenic uranium. Pitchblende is associated with disseminated sulfides and hematite throughout a shear zone in structurally deformed and metasomatized Precambrian schists. Uranium content shows zoning with the highest grades associated with the hematite. The deposit yielded 12,000 tons of U_3O_8 at an average grade of 2.34 percent.

8. Anatectic uranium deposits are restricted to a particular suite of granitic rocks whose origin may be igneous and metamorphic. Pegmatites, aplites and alaskites are considered of anatectic origin in an enclosing environment of metasediments. Uranium-bearing solutions affect the concentration of primary uraninite and uranothorite into tabular and lens-shaped bodies that conform to rock foliation and structural features. Steep isoclinal folding is characteristic of the host environment.

The Rossing deposit located in Namibia is confined to complex folding in anatectic alaskites emplaced along shears, fractures and bedding planes of metasedimentary and metavolcanic schists and gneisses, which make up the Khan and Rossing Formations. Uraninite is well disseminated throughout the alaskite, and secondary uranium occurs in both the alaskite and metasediments. The deposit is currently being mined.

C. Volcanogenic Uranium Deposits

Uranium in volcanogenic rocks is classified according to four ore-forming processes which can develop during phased stages of volcanogenesis. Each relates to a geologic setting identified as favorable for hosting uranium mineralization. The genesis of caldera structures is considered a primary uranium-concentrating mechanism for volcanogenic deposits. The most important volcanogenic uranium deposits are directly related to such structures which formed during the Tertiary Period. Uranium is syngenetic to the volcanic process; it is a constituent in volcanic source rock, associated gases, and in trapped or migrating fluids. Concentrating mechanisms relate to changes in temperatures and pressures affecting the magma. The four ore-forming processes represent different stages of caldera volcanism relative to the development of ring fractures, initial surface eruptions, caldera collapse, cauldron-basin

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sedimentation, resurgence of volcanism, resurgent doming, and the final stage of volcanism associated with old and new ring fractures.

1. Initial-magmatic uranium occurs as disseminations of uranium and uranium-bearing minerals during the liquid phase of deep-seated magmas. The mixing of magmas and hydrothermal fluids concentrates the uranium, thus providing the source of mineralization. The continued migration of magma and subsequent cauldron-forming processes provide the environment for accumulation of uranium (extremely fine-grained uraninite). Uranium deposition occurs during crystallization of the magmas. The uranium may become further concentrated through the process of remobilization during a later phase of volcanogenesis (caldera collapse or domal resurgence). Deposits in the Sierra Pena Blanca district, located in Chihuahua, Mexico, are in this class.

2. Pneumatogenic uranium deposits develop from uranium-rich gases emanating from magma during late stages of caldera development. The gases continue to emanate from the magma during periods of surface eruption and the wide distribution of ash-flow tuffs. Uranium tends to concentrate in veins and breccia-collapse zones formed in the intrusive or extrusive magmas and ash flows during the period of abrupt changes in temperature and pressure. Pitchblende is the main uranium mineral present, usually forming in low-grade concentrations of questionable economic value. However, ore grades of about 0.20 percent U_3O_8 have been encountered in deposits of Mexico's Sierra Pena Blanca district.

3. Hydrouthigenic uranium occurrences developed from a source of highly siliceous uranium-rich fluids. The fluids were condensed from volcanic gases generated during the eruptive phase of caldera development. The gases were trapped in voids and pore-space of ash flows. Concentration of uranium results from magma cooling and depressurization. The uranium mineral is uranophane, a calcium-rich uranosilicate. Uranium deposits of this class occur in the Sierra Pena Blanca district of Mexico and at the Mammoth Prospect, Presido County, Texas. At Mammoth, uranophane occurs in cavities in welded bands of the Buckshot Ignimbrite. The deposit is small and has not been exploited.

4. Hydroallogenic occurrences consist of epigenetic uranium formed in country rock environments adjacent to the volcanic system. Uranium, in the form of uranosilicate, originates from entrapped fluids released during internal movement of magmas and surface eruptions. The redistribution of syngenetic uranium by ground-water migration may contribute to the concentrating process during late-stage cauldron development. Uranophane is the main uranium mineral present. Uranium occurrences in this class are found in the Sierra Pena Blanca district of Mexico, the Virgin Valley of Nevada, and at the Spancevo deposit in northeastern Yugoslavia.

D. Uranium Deposits of Uncertain Genesis

There are three types of uranium occurrences in this classification — Unconformity-related deposits, vein-type deposits in metamorphic rocks, and vein-type deposits in sedimentary rocks. Unconformity-related deposits represent some of the largest and highest-grade deposits discovered to date. The uncertainty of ore genesis is the only common characteristic in the three classes. In question are the source of uranium and uranium-bearing solutions, mode of transportation, lithologic and structural controls, and the role of reductants. Each aspect is important to uranium concentration processes.

Uranium contained in deposits of this classification is epigenetic, and is available from multiple sources. Uranium leached from older granitic rocks is probably the main source. Most granitic rocks contain 3 to 5 parts per million (ppm) uranium; some contain up to 100 ppm. Uranium in granites is readily leachable during the movement of oxidizing solutions. Traces of uranium in sedimentary rocks are common, especially in the dark shales. The wide spread movement of oxidizing solutions through sediments is the initial phase for the leaching process — uranium becomes highly mobile in an oxidizing environment. The third source of uranium is hydrothermal solutions associated with metamorphism. Deep-seated solutions are carriers of uranium-bearing minerals which tend to mobilize and concentrate during the metamorphic process.

An oxidizing environment is required to mobilize the uranium, and a reducing environment is necessary to precipitate the uranium. The presence of a few common reductants such as ferrous-iron, sulfides, graphite and carbon indicate a reducing process. Uranium-bearing solutions making contact with any reductants in a favorable host will start the precipitation process. Fracturing, faulting and brecciation represent favorable host conditions.

1. Unconformity-related uranium deposits are confined to the major unconformity sequence separating Precambrian shield rocks from overlying Lower Proterozoic metasediments. Wide-spread structural deformation and metamorphism is established in the basement rock. However, locally controlled vein systems associated with fracturing, faulting and brecciation, in addition to intense weathering, becomes the sites for major uranium concentrations. Structural features originated at depth in the basement rock and usually extend upward for some distance into the metasediments. Likewise, mineralization may follow the favorable structural (and alteration) environment above and below the unconformity. Graphite schists

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are usually closely associated with uranium accumulations. Pitchblende and coffinite are the main uranium minerals present, forming large-tonnage ore deposits that may average about 2.50 percent U_3O_8, but often containing values that commonly exceed 50 percent U_3O_8. The mineralizing process is dated at 2,000 to 1,600 million years old, while the age of the host formations is estimated at 2,500 to 2,200 million years.

Important uranium deposits in this class include the majority of deposits located in the Athabasca Basin of northern Saskatchewan. Specifically, uranium in the Cluff Lake deposit and the deposits along the Key Lake/Rabbit Lake trend is primarily, but not exclusively, concentrated in the regolith zone at the unconformity. Uranium in the Cigar Lake deposit to the northwest of the trend is largely confined to the Athabasca Quartzite above the unconformity.

The Jabiluka deposit, located in the East Alligator River district in Australia's Northern Territory, is an unconformity-related uranium deposit. Uranium has concentrated in chlorite muscovite-rich metasediments at the unconformity between Lower and Middle Proterozoic units. The ore zone extends downward into the Lower Proterozoic Cahill Formation. The Ranger deposit, which is located about 20 km south of Jabiluka, occurs in a similar environment with relation to the unconformity.

2. Vein-type uranium deposits in metamorphic rocks usually form in secondary structural features including fractures, faulting and brecciation. The uranium is introduced into the vein system by hydrothermal solutions accompanying metamorphism. Pitchblende is the main uranium mineral precipitated in the veins and as finely disseminated particles in the vein host rock. A vein system usually follows the favorable structural features to considerable depth, creating the potential for a large-tonnage ore deposit.

Deposits in the Beaverlodge area of Northern Saskatchewan are metamorphic vein-type. The uranium-bearing veins are concentrated in highly foliated and brecciated rocks of Lower Proterozoic age. Pitchblende mineralization formed large, high-grade deposits associated with the pattern of foliation.

3. Vein-type uranium deposits in sediments make up the third category. Vein-type deposits cut across the normal pattern of sedimentation at angles from almost horizontal to vertical. Uranium fills veins in fractures, breccia zones, and faults associated with deformation of sediments. The source of mineralization in vein-type deposits is uncertain. It may have been introduced through migrating (ascending mineral-rich brines or descending mineral-rich groundwater) solutions in a brecciated or fractured host, and possibly as second-stage mineralization resulting from supergene enrichment-type and remobilization of uranium as in stratiform deposits.

The common example of vein-type deposits are the breccia pipes found throughout northern Arizona. In a pipe, the zone of brecciation penetrates sediments from Mississippian limestone up through Triassic sand units. Mineralization of the breccia zone is estimated to have occurred during late Triassic and possibly early Jurassic time. Abundant pyrite and organic material present in the upper formations served as reducing agents that stimulated uranium precipitation. The main uranium mineral present is uraninite occurring in association with various sulfide minerals such as sphalerite, galena, chalcopyrite and molybdenite.[3] Several deposits in breccia pipes presently are being mined.

[3]See "Mineralization of Breccia Pipes in Northern Arizona," by K. J. Wenrich, Economic Geology, Vol. 80, 1985, pp. 1722-1735.

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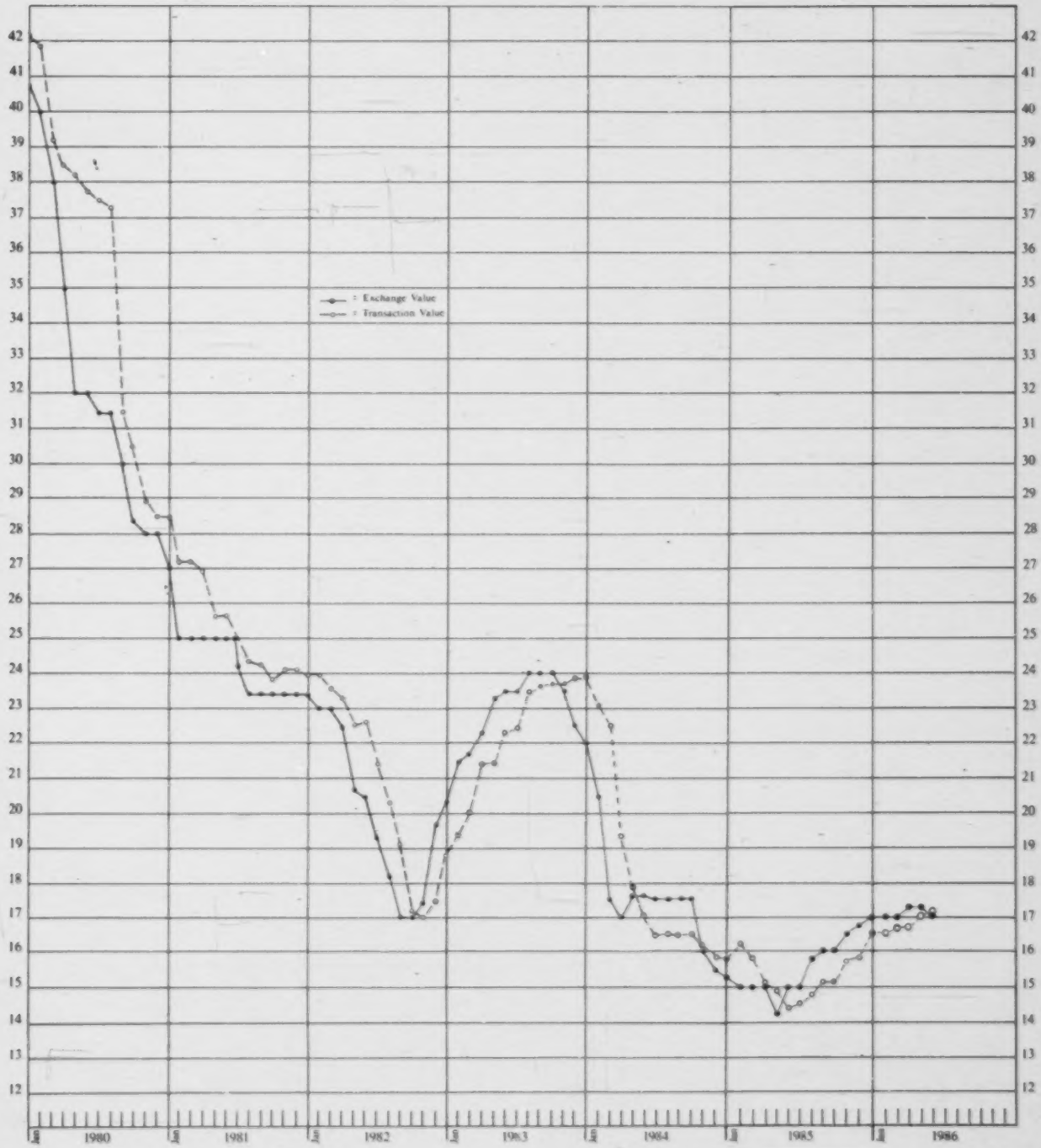
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	**17.00**							

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	**17.15**							

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1 10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	**1.80**							

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3 4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.8
Jun 1985	108.7	202.8
Jul 1985	111.1R	202.8
Aug 1985	110.5	202.8
Sep 1985	108.9	202.8
Oct 1985	108.7R	202.8
Nov 1985	109.6	210.2
Dec 1985	110.2	210.3
Jan 1986	109.8P	210.3
Feb 1986	109.1P	210.3
Mar 1986	—	210.3

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2]Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3]Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4]Annual averages prior to 1979 reflect index base no longer in use.

[5]Monthly data for 1979-82 appear on page 35 of Report 184.

[6]Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	118.9	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.1R	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	119.7R	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	120.6R	18.15	16.22R	15.86	13.11R	11.48R	12.52R
Feb 1986	120.5	19.52R	16.57R	15.99R	13.20R	11.59R	12.45R
Mar 1986	120.0	19.04P	16.22P	15.89P	13.15P	11.63P	12.59P

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3]Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4]Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5]Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6]Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7]Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8]Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	—
Feb	1986	—	—	215.8	206.9	752,500	—
Mar	1986	75.76	167.8	218.3	206.9	758,884	—
Apr	1986	—	—	222.2	—	—	—

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2]Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3]Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4]The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5]Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6]Bulletin of Statistics, Department of Statistics, Pretoria.

[7]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8]Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9]Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.66	11.67	9.55
Oct 1985	324.2	307.9	325.5	—	13.49	13.64	11.72	9.56
Nov 1985	324.7	309.5	326.6	—	13.49	13.95	11.82	9.61
Dec 1985	325.1R	310.2	327.4	113.0	13.43	13.78	11.87	9.68
Jan 1986	324.0	309.0	328.4	—	13.40	13.67	11.87	9.61
Feb 1986	319.4	304.7	327.5	—	13.44R	13.79R	11.83R	9.60R
Mar 1986	314.0	300.3	326.0	113.7	13.24P	13.90P	11.79P	9.63P
Apr 1986	311.3	297.9	325.3	—	—	—	11.82P	9.63P

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2]US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3]US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4]The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5]US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7]Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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